

# Advanced Elevator Display Panel

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**Abstract**—The present elevator panels offer just simple light emitting diode displays and some buttons to select the desired floor. We have designed an embedded system which offers more than the present elevator panels. It efficiently operates the elevator drive mechanism and also has a thin film transistor display. Besides just driving the elevator it also monitors various parameters in the elevator and displays them on the screen. Also if the parameters cross their safety limits audio and visual alerts are given to warn the commuters of the elevator. The system consists of a microcontroller unit which is the brain of the system, a thin film transistor screen and a temperature sensor.

**Keywords**—Thin film transistor display, real time clock, graphic controller

## I. INTRODUCTION

The current elevator panels are not much sophisticated. It barely has some buttons and a simple 7-segment light emitting diode (LED) display. We have designed an embedded system which is beyond the traditional elevator panels and much more advanced. We are targeting the areas of application where stand-alone operations and modified look is not possible. The embedded system is meant for controlling the elevator and it also offers remote monitoring of parameters. The system keeps track of the temperature inside the elevator car. Also the system monitors the temperature and if temperature crosses its limit the elevator is immediately halted. Besides, these features audio and visual alerts are also given in case of emergency. The system is coupled with the flawless power supply and a thin film transistor (TFT) display. The circuit board is optically isolated to protect the onboard components from high voltage.

## II. HARDWARE & SOFTWARE PLATFORM

### A. Embedded Board

Embedded board based on AVR microcontroller is used, it contains temperature sensor, graphic controller chip, real time clock chip, TFT screen display etc., all on the same board. Elevator control card is connected to the embedded board. Board has various features like: AVR Atmega328P microcontroller, temperature sensor, 4.3 inches thin film transistor (TFT) display, graphic controller circuitry, real time clock (RTC) chip, three onboard keys for time and date settings and power supply of 3.3V to 5V.

### B. Software Platform

Arduino integrated development environment (IDE) is used for burning a boot-loader using in-system programming (ISP) and the same IDE is used to burn source code using USB port.

## III. METHODOLOGY

Set-up consists of ATmega328P controller, power supply (0-5 V) is for operation control, thin film transistor (TFT) display for displaying floor number and up/down arrow, elevator control card circuit & graphic controller circuit and micro SD card. The microcontroller unit gets input from elevator control card, those inputs are like floor numbers, up or down direction of elevator card and setting of date and time. Then according to input to microcontroller, the respective floor number and direction of elevator car is shown on TFT display.

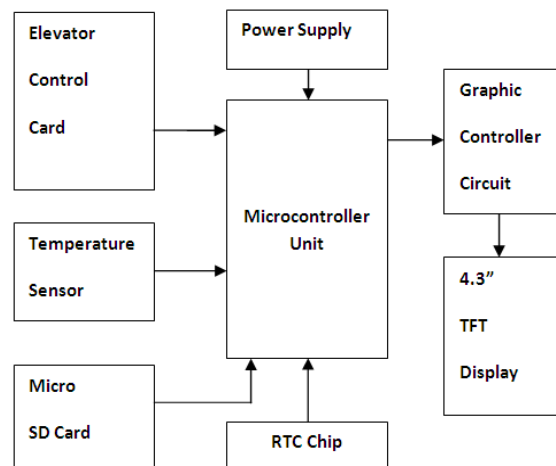


Figure1: Basic block description of the system.

### A. Power Supply

The power supply ranging from 3.3V to 5V is designed for whole system. The LM2576 is a regulator which is monolithic integrated circuit that provides all the active functions for a step-down switching regulator and this regulator drives 3A load. Two regulators of fixed output voltage of 3.3V and 5V are used for the system. The most important feature of LM2576 is, it includes a fixed frequency oscillator and also internal frequency compensation. As a result of this no heat sink is required.

### B. Elevator control card

The elevator control card is used to control access to floors serviced by an elevator. This control card also consists of a simple microcontroller circuitry. The card gets inputs from the key panel inside the elevator car. These inputs are like floor number, setting date and time, emergency alarm, etc. This card gives output to main microcontroller circuitry and outputs are like floor number, direction of elevator car, etc.

### C. Temperature sensor

The LM35 is a precision integrated-circuit temperature sensor. The output voltage of the LM35 varies 10 mV per degree Celsius and also is linearly proportional to the centigrade temperature. Any external calibration or trimming for LM35 is not required to provide typical accuracies of  $\pm 1/4^\circ\text{C}$  at room temperature and  $\pm 3/4^\circ\text{C}$  over a full  $-55^\circ\text{C}$  to  $+150^\circ\text{C}$  temperature range. The LM35 has low output impedance, linear output. Also because of precise inherent calibration of the LM35, reading the output value and further controlling actions become easy. The LM35 has very low self-heating of less than  $0.1^\circ\text{C}$  in still air because it draws only 60  $\mu\text{A}$  from the supply. It is rated to operate over a  $-55^\circ\text{C}$  to  $+150^\circ\text{C}$  temperature range. The LM35, in the system, is used to detect the temperature of the elevator and its analog output is provided to ATmega microcontroller.

### D. Micro SD Card

The SD Card is interfaced with microcontroller for storing the pictures of floor number and other pictures regarding the fire and overload warnings. Besides, it also contains an audio file in case to give any alarm signal. Whenever an input of floor number is provided by user through a keypad, the microcontroller interacts with SD card to get the corresponding floor numbers and displays them on the TFT screen.

### E. Graphic Controller chip

The FT800 is an easy to use graphic controller targeted for embedded applications to generate high-quality Human Machine Interfaces (HMIs). It provides a powerful feature set in a small package to create dynamic HMI interfaces. This device supports line by line graphics rendering to 1/16 of a pixel on displays with resolution up to 512 x 512 with 262K colors. The chip includes a touch controller for sensing touch feedback from a TFT display with a resistive touch panel as well as a sound synthesizer and audio playback with a PWM output to drive a speaker. The FT800 calculates for 8-bit color despite only providing pins for 6-bit (RGB-6, 6, 6); this improves the half tone appearance.

### F. Microcontroller ATmega-328P

ATmega328 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. This microcontroller is based on enhanced RISC (Reduced Instruction Set Computing). Most of the instructions execute in one machine cycle. ATmega328P can work on a maximum frequency of 20MHz @ 1.8 – 5.5 V. It has 32 KB programmable flash memory, static RAM of 2 KB and EEPROM of 1KB. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000, respectively. ATmega328P is a 28-pin microcontroller. There are 23 I/O (input/output). It

has in-built 10-bit six channel analog to digital (A/D) converter. It has two 8-bit timers and one 16-bit timer. It has six PWM channels. Also it has various in-built peripherals like USART, ADC, SPI, JTAG etc.

### G. Real time clock (RTC) chip

The DS1307 serial real-time clock is a low-power, full binary-coded decimal (BCD) clock/calendar plus 56 bytes of NV SRAM. The RTC is required to display time, date and day on TFT screen. Address and data are transferred serially through a bidirectional bus which is I2C. The clock or calendar provides hours, minutes, seconds, day, date, month, and year information. Leap year correction facility is also there. The clock can be operated either in the 24-hour or 12-hour format with AM and PM indicator. The DS1307 has an in-built circuitry for power-sense which detects power failures and it automatically switches to the backup supply. Battery backup is used to continue the timekeeping operation.

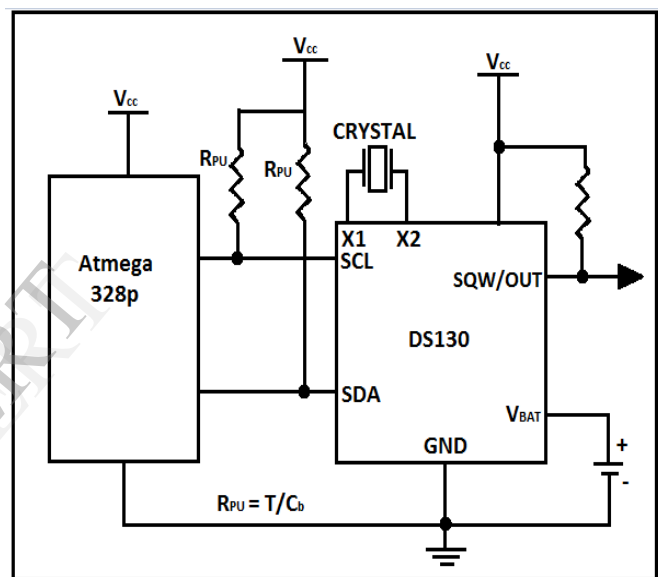


Figure2: Block description of RTC interfacing with microcontroller.

### H. Thin film transistor (TFT) display

The thin film transistor (TFT) display is a 4.3" (109.22mm) diagonal screen size display. Its display mode is transmissive with having a backlight of LED- White. It has dot pixels of 480x272 resolutions. The thin film transistor (TFT) display is used for displaying floor number, up/down arrow, time, date and temperature inside the elevator car.

### I. Opto-coupler

The PC817 opto-coupler is a 4-pin semiconductor device that allows signals to be transferred between circuits, while keeping the circuits electrically isolated from each other. It consists of a light-emitting diode (LED) for signal transmission, and a phototransistor for signal reception. The "transmitter" takes the electrical signal and converts it into a beam of modulated visible light. This beam of light travels across a transparent gap and is picked up by the "receiver," which converts the modulated light back into an electrical signal.

### J. USB to UART chip

The FT232RL is a USB to serial UART interface with optional clock generator output. In addition, asynchronous and synchronous bit bang interface modes are available. USB to serial UART designs using the FT232RL have been further simplified by fully integrating the external EEPROM, USB resistors and clock circuit onto the device. It adds two new functions compared with its predecessors, effectively making it a "3-in-1" chip for some application areas. The internally generated clock (6MHz, 12MHz, 24MHz, and 48MHz) can be brought out of the device and used to drive a microcontroller or external logic. A unique number is burnt into the device during manufacture and is readable over USB, hence forming the basis of a security dongle which can be used to protect customer application software from being copied. The FT232RL is available in Pb-free compact 28-Lead SSOP and QFN-32 packages.

## IV. RESULT

The following figure shows the final output of our system. TFT display is used to display output. As we see on left half of screen, floor number is displayed and on right half, there is a direction arrow of the elevator car. Also it shows the real time and date on the screen. Also it shows the carrying capacity of the elevator car.

The TFT screen also displays text regarding company name or any important message or news, which is scrolling horizontally as shown in following figure.



Figure3: TFT display showing final output of the system.

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